Test Review:

- Variables: Units:

t	s
$\bar{v}_i, \bar{v}_{ix}, \bar{v}_{iy}$	m/s
$\bar{a}_g$ (= 9.8 down)	m/s^2
$\bar{a}_x = \emptyset$	m/s^2
$\bar{v}_f, \bar{v}_{fx}, \bar{v}_{fy}$	m/s
θ_i, θ_f	degrees

- Equations:

$$\Delta x = v_{ix} t$$

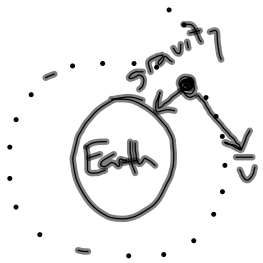
$$\Delta y = v_{iy} t + \frac{1}{2} a_g t^2$$

$$v_{fy} = v_{iy} + a_g t$$

$$v_{fy}^2 = v_{iy}^2 + 2 a_g \Delta y$$

- Launched object is called a <u>projectile</u>.

- What is "floating in space?"



An object is continuing to fall

- Best angle to launch for maximum Δx:
  - Without air resistance, 45°.

- Initial velocity angles:

$\theta_i > 45°$, $\bar{V}_{iy} > \bar{V}_{ix}$

$\theta_i = 45°$, $\bar{V}_{iy} = \bar{V}_{ix}$

$\theta_i < 45°$, $\bar{V}_{iy} < \bar{V}_{ix}$

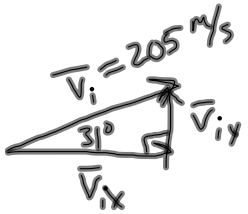
Cannon launches a ball at 31° with a velocity of 205 m/s. If the ball travels 1020 m in the x-direction, find

a) time it is in the air.

b) maximum height.

a) $\Delta x = v_{ix} t$

$$t = \frac{\Delta x}{v_{ix}} = \frac{1020\ m}{175.7\ m/s} = 5.8\ s$$



$\cos(31°) = \frac{v_{ix}}{v_i}$

$v_{ix} = v_i \cos(31°)$

$= 175.7$ m/s

$v_{iy} = v_i \sin(31°)$

$= 105.6$ m/s

b) max. height → occurs at half-time

$t = 2.9$ s

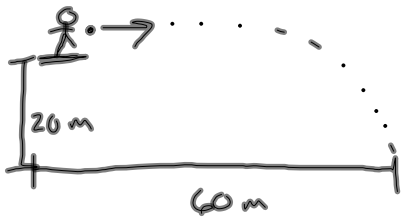
$$\Delta y = v_{iy} t + \frac{1}{2} a_g t^2$$

$$= (105.6\ m/s)(2.9\ s) + \frac{1}{2}(-9.8\ m/s^2)(2.9\ s)^2$$

$$= 265\ m$$

Test Review and Practice Problems 2.27.12 CP Physics

A boy standing on a balcony 20 m off the ground throws a ball 60 m in the x-direction.
a) With what initial velocity (horizontally) did the boy throw the ball?
b) With what final velocity did the ball have just before it struck the ground (magnitude, angle, direction)?



a) $v_{iy} = 0$ m/s

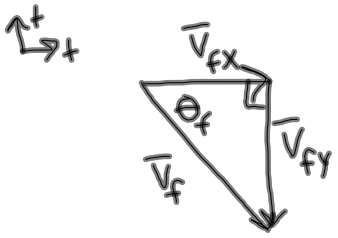
$$\Delta y = \cancel{v_{iy}^{\,0}t} + \frac{1}{2}a_g t^2$$

$$t = \sqrt{\frac{2\Delta y}{a_g}} = \sqrt{\frac{2(-20\text{m})}{(-9.8\text{ m/s}^2)}} = 2.02\text{ s}$$

$$\Delta x = v_{ix}t$$

$$v_{ix} = \frac{\Delta x}{t} = \frac{60\text{ m}}{2.02\text{ s}} = 29.7\text{ m/s}$$

b) make a final velocity triangle



Direction: S of E

$v_f = 35.7$ m/s

$\theta_f = 33.7°$

$v_{fx} = v_{ix} = 29.7$ m/s

$v_{fy} = \cancel{v_{iy}^{\,0}} + a_g t$

$= (-9.8\text{ m/s}^2)(2.02\text{ s})$

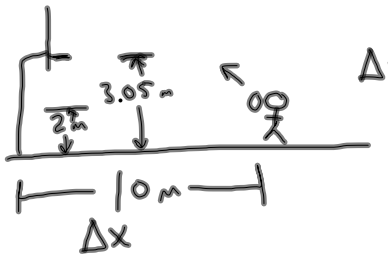
$= -19.87$ m/s

Pythag. thm.

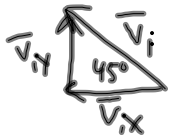
inverse tan

Test Review and Practice Problems 2.27.12 CP Physics

A 2.00 m tall basketball player attempts a goal 10.00 m from the basket (3.05 m high). If he shoots the ball at a 45 degree angle, at what initial speed must he throw the basketball so that it goes through the hoop without striking the backboard?



$\Delta y < 1.05\ m$



$\bar{v}_{ix} = \bar{v}_{iy}$

$\Delta x = v_{ix} t$ $\quad \Delta y = v_{iy} t + \frac{1}{2} a_g t^2$

$\Delta x = v_{iy} t$ $\quad \Delta y = v_{iy}\left(\frac{\Delta x}{v_{iy}}\right) + \frac{1}{2}(a_g)\left(\frac{\Delta x}{v_{iy}}\right)^2$

$t = \frac{\Delta x}{v_{iy}}$ $\quad \Delta y = \Delta x + \frac{a_g (\Delta x)^2}{2 v_{iy}^2}$

$\Delta y - \Delta x = \frac{a_g (\Delta x)^2}{2 v_{iy}^2}$

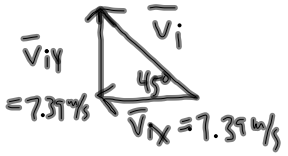
$\uparrow^{+}$ so $a_g = -9.8\ m/s^2$

$v_{iy}^2 = \frac{a_g (\Delta x)^2}{2(\Delta y - \Delta x)}$

$v_{iy} = \sqrt{\frac{a_g (\Delta x)^2}{2(\Delta y - \Delta x)}}$

$= \sqrt{\frac{(-9.8\ m/s^2)(10\ m)^2}{2(1.05\ m - 10\ m)}}$

$= 7.39\ m/s$



Pythagorean thm. to find v_i

$v_i = 10.45\ m/s$